REMARKS

Claims 18 and 19 have been cancelled and replaced with new claims 28 and 29. Claims 20, 21, 24 and 25 have been cancelled. Claims 22 and 23 have been amended. Claims 26 and 27 have been allowed and remain in the application. Reexamination and reconsideration of the pending claims are respectfully requested.

In the prior Office Action, claims 18 and 19 were rejected as obvious over JP 7-20050 (JP '050) in view of Murakami et al. (JP '436). Claims 20-25 were rejected as obvious over JP '050 in view of Kliman (US 5,117,553). Applicants respectfully submit newly presented claims 28 and 29, along with dependent claims 22 and 23, are patentable over the cited references as will be discussed below.

Applicants newly presented claims 28 and 29 recite an electromotive vehicle drive using a permanent magnet electric rotating machine. A rotor associated with a stator has a rotor iron core and plural permanent magnets embedded in magnet insertion holes in the rotor iron core. Auxiliary magnetic pole portions for generating a reluctance torque, and magnetic air gaps for restraining a cogging torque are formed in the rotor iron core. The magnet insertion holes are arranged around the rotor in a ring-shape in an inner portion of the rotor iron core.

Each of the permanent magnets are one of a rectangular solid, arc, or trapezoid shape so as to be inserted in an associated insertion hole to form a reverse polarity characteristic alternatively. The auxiliary magnetic pole portions are formed between adjacent permanent magnets in a peripheral

direction about the rotor. The magnetic air gaps are arranged in the inner portion of the rotor iron core between an end portion of one of the permanent magnets and one of the auxiliary magnetic pole portions. Thereby, a change in a magnetic flux density distribution of the permanent magnets occurring between the permanent magnets and the auxiliary magnetic pole portions is formed smoothly.

Newly presented claim 29 is substantially similar to claim 28 but further recites the use of non-magnetic members provided in the magnetic air gaps.

By contrast to Applicant's claimed invention, JP '050 does not teach or suggest Applicants' claimed invention.

JP '050 describes a rotor for a permanent magnet synchronous electric motor. Slots 5 are provided in the rotor core for every one pitch, and permanent magnets 5a are fitted into the slots 5 to form the same polarity characteristic in the radial direction.

JP '050 discloses holes 6, which are arranged with the pole number pitches of the rotor core 4 in a vicinity of the outer periphery to prevent leakage magnetic flux. However, in JP '050, the adjacent permanent magnets 5a have the same polarity characteristic, rather than a reverse polarity characteristic as in the present invention. Accordingly, in JP '050, the rotor core portions between the adjacent permanent magnets 5a do not form auxiliary magnetic pole portions, which generate a reluctance torque, but form the main poles, which have the different polarity characteristics with the adjacent permanent magnets 5a.

In summary, JP '050 does not disclose or suggest auxiliary magnetic pole portions for generating a reluctance torque, which is an important feature of Applicants' claimed invention.

Moreover, because JP '050 does not have auxiliary magnetic pole portions, the magnetic flux density of the permanent magnet has a smooth course such as that of a sine curve.

Because JP '050 does not have any auxiliary magnetic pole portions, it is impossible to obtain the trapezoidal wave form which amplitudes in an up-and-down direction by sandwiching the portion in which the magnetic flux density distribution of the permanent magnet is made to zero as is shown in the present invention (see Fig. 4b). Accordingly, JP '050 does not present the same technical problem shown in the present invention, which is the restraint of the cogging torque according to the magnetic flux density distribution of the permanent magnet.

Hence, in JP '050, it is unnecessary to provide magnetic air gaps in the peripheral direction between an end portion of the permanent magnet and an auxiliary magnetic pole portion, and, it is also unnecessary to form smoothly the slope of the magnetic flux density distribution of the permanent magnet.

Indeed, in JP '050, the hole 6 provided in the peripheral direction end portion of the permanent magnet does <u>not</u> attain the operation and effect for smoothly forming the slope of the magnetic flux density distribution of the permanent magnet.

Accordingly, unlike Applicants' claimed invention, JP '050 does not describe or suggest magnetic air gaps for restraining a cogging torque, which is an important feature of the present invention.

Moreover, since in JP '050 there is no auxiliary magnetic pole portion, it is impossible to generate a reluctance torque as in the present invention. Hence, it is impossible to output the necessary high torque during the starting of the electromotive vehicle and, further, it is impossible to carry out a necessary weakening of the magnetic field control at high RPM's.

By contrast, according to Applicants' invention, because the permanent magnet electric rotating machine has an auxiliary magnetic pole portion, it outputs the necessary high torque during the starting of the electromotive vehicle and it is also possible to weaken the magnetic field control when necessary. As a result, Applicants' invention provides a permanent magnet electric rotating machine advantageously usable with electromotive vehicles.

Regarding the secondary JP '436 reference, the rotor described in that reference is one in which the permanent magnet 8, having the same number of magnetic field portions 6 and having different pole characteristics between the adjacent permanent magnets, is embedded into the outer peripheral portion of the rotor main body 3a. In JP '436, the adjacent permanent magnets 8 have different polarity characteristics and, between adjacent permanent magnets 8 an auxiliary magnetic pole portion is indeed formed.

However, JP '436 is completely silent with respect to any magnetic air gaps for restraining a cogging torque in a peripheral direction end portion of the permanent magnet. Accordingly, in JP '436, the slope of the magnetic flux

density distribution of the permanent magnet changes abruptly in comparison with that of the present invention (compare prior art Fig. 5b v. Fig. 4b). In essence, because the slope of the magnetic flux density distribution in JP '436 is nearly a rectangular waveform, it is impossible to restrain cogging torque.

Regarding the combination of JP '050 in view of JP '436 as set forth in the Office Action, Applicants respectfully submit the present invention is still not achieved.

As noted above, the holes 6 in the permanent magnet synchronous electric machine of JP '050 are provided to prevent leakage magnetic flux of the permanent magnet. Accordingly, if such holes were applied to the permanent magnetic electric rotating machine of JP '436, in order to shield the route passage in the radial direction of the auxiliary magnetic pole portions, the air gap will be provided with a peripheral direction width almost that of the auxiliary pole portion.

As a result, even if one skilled in the art were to combine these references, it would still not be possible to generate the reluctance torque by utilizing the auxiliary magnetic pole portions.

On the other hand, in the present invention, since the magnetic air gap is provided between the peripheral direction end portion of the permanent magnet and the auxiliary magnetic pole portion, the auxiliary magnetic pole portion for generating the reluctance torque is maintained, and it is also possible to restrain the cogging torque according to the magnetic air gap.

Accordingly, even if the holes of the synchronize electric machine of JP '050 were applied to the rotating machine of JP '436, one skilled in the art still

does not arrive at a permanent magnet electric rotating machine having auxiliary magnetic pole portions for generating a reluctance torque and magnetic air gaps for restraining the cogging torque. Because these features are recited in each of Applicants' independent claims 28 and 29, it is respectfully submitted that the claims are patentable over these references, whether taken alone or in combination.

For the foregoing reasons, Applicants submit claims 28 and 29 are now in condition for allowance, along with dependent claims 22 and 23. An early notice to that effect is solicited.

Summarizing, Applicants have made an important contribution to the art to which the present subject matter pertains, for which no counterpart is shown in any of the art or combination of same. The invention is fully set forth and carefully delimited in all claims in this case. Under the patent statute, Applicants should not be deprived of the protection to which they are entitled for this contribution. Accordingly, it is respectfully requested that favorable reconsideration and an early notice of allowance be provided for all remaining claims.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

It is respectfully requested that, if necessary to effect a timely response, this paper be considered as a Petition for an Extension of Time sufficient to effect a timely response and shortages in other fees, be charged, or any overpayment in

fees be credited, to the Deposit Account of Crowell & Moring, L.L.P., Account No. 05-1323 (Docket #381NP/43816CO.

Respectfully submitted,

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